Results of forest insect and disease surveys in the NORTHERN REGION of Ontario, 1990

CARRIED OUT BY THE GREAT LAKES FORESTRY CENTRE IN COOPERATION WITH THE ONTARIO MINISTRY OF NATURAL RESOURCES

W.A. Ingram, S. Payne and B.E. Smith

Miscellaneous Report No. 102

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FORESTRY CANADA, ONTARIO REGION

Ontario Region is one of six regional establishments located across Canada and operated by Forestry Canada. The overall objective of Forestry Canada is to promote the preservation, enhancement and wise use of a healthy, attractive and bountiful forest resource and terrestrial environment for the economic and social benefit of all Canadians. Ontario Region pursues this objective by conducting two major programs: research and technical services and forestry development. Both programs address major problems affecting forest management and the forest environment primarily in Ontario, but because of the transprovincial nature of the forest resource, many elements of our research program are of national significance.

Ontario Region specializes in research in forest production, forest protection, forest environment and forest utilization. These programs deal directly with the issue of maintaining and enhancing the resource supply. Activities range from basic to applied and developmental research, and include a significant technology transfer component.

Major activities in forestry development include federal management responsibility for federal-provincial forest management agreements, participation in the National Forestry Statistics program and forest economics research.

Close working relationships are maintained with the Ontario Ministry of Natural Resources, the forest industry, educational institutions specializing in forestry and the biological sciences, and other forestry organizations within the province. Ontario Region is represented on the Ontario Forestry Council and the Ontario Forestry Research Committee, which have responsibility for coordinating forestry research in Ontario.

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92-05199/

RESULTS OF FOREST INSECT AND DISEASE SURVEYS IN THE NORTHERN REGION OF ONTARIO 1990

(FOREST DISTRICTS: MOOSONEE, HEARST, KAPUSKASING, COCHRANE, CHAPLEAU, TIMMINS, KIRKLAND LAKE and GOGAMA)

W.A. Ingram, S. Payne and B.E. Smith

FORESTRY CANADA

ONTARIO REGION

GREAT LAKES FORESTRY CENTRE

1991

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SURVEY HIGHLIGHTS

This report documents the insects, diseases and abiotic conditions examined in the Northern Region of Ontario in 1990.

The Forest tent caterpillar once again proved to be the most destructive insect in the Region, with a total of 921,993 ha of moderate-to-severe defoliation mapped in the Hearst, Kapuskasing, Moosonee and Timmins districts. Forecasts made on the basis of egg-band counts across these districts indicate a general increase in the area affected in all areas for 1991.

Populations of the spruce budworm have generally increased throughout the Region in 1990 and 6,392 ha of moderate-to-severe defoliation were aerially mapped in Hearst District in the area of Nagagamisis Lake. Egg-mass sampling across the Region indicates a further increase is expected in 1991 in Hearst District, as well as general increases in the Chapleau, Kapuskasing, Kirkland Lake and Timmins districts.

In a continuing effort to monitor forest health across the Region, the two birch plots established in 1989 were again surveyed and soil samples were collected for analysis; the ARNEWS plots established in 1985 had their 5-year reassessment completed. This assessment included all mensurational measurements as well as both soil and foliar sampling.

Other conditions monitored were the presence of the black army cutworm in recently burned areas that are scheduled for planting and the insect and disease conditions that presently exist in the Region's seed orchards.

The most common disease organism found on spruce in natural situations and plantations was spruce needle rust. However, gall rusts and Armillaria root rot were by far the most destructive diseases encountered in young pine plantations evaluated across the work area.

The same format was followed in categorizing forest pests as in the 1989 Northern Region report:

Major Insects/Diseases

capable of causing serious injury to or death of living trees or shrubs

Minor Insects/Diseases

capable of causing sporadic or localized injury but not usually a serious threat to living trees or shrubs

Other Forest Insects/Diseases

These tables provide information on two types of pest:

(1) those that are of minor importance and have not been known to cause serious damage to forest trees;

(2) those that are capable of causing serious damage but, because of low population levels or for other reasons, did not cause serious damage in 1990.

The cooperation and assistance provided by personnel of the Ontario Ministry of Natural Resources (OMNR), wood-using industries and other government agencies, and of many individuals, are gratefully acknowledged.

W.A. Ingram
S. Payne
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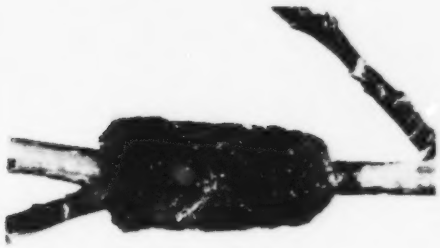
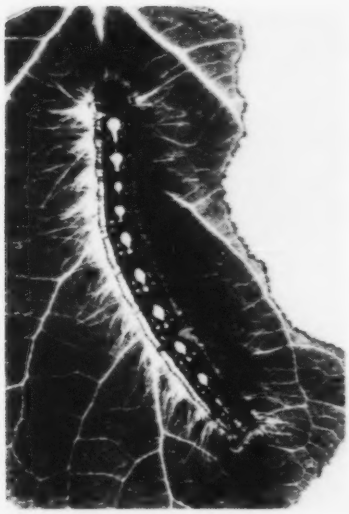
FRONTISPIECE

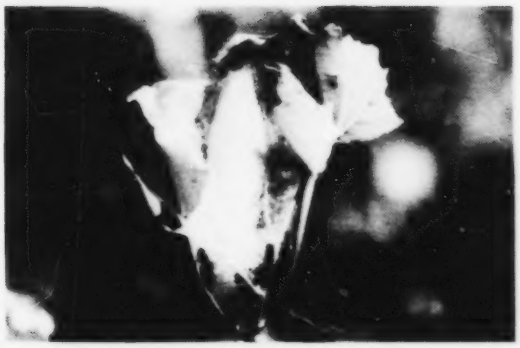


Egg band



Larva

Moth



Pupa

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INSECTS

Major Insects

Birch Skeletonizer, *Bucculatrix canadensisella* Cham.

A new infestation has occurred across the central portion of Northern Region. Defoliation of white birch (*Betula papyrifera* Marsh.) in the 80-100% range extended in a 20- to 40-km-wide band from the vicinity of Oba in Hearst District in the west across Kapuskasing District to the area of Fraserdale in Cochrane District.

Pockets of heavy defoliation were also recorded in Timmins District, especially southwest of the city of Timmins, and in Kirkland Lake District. Additional small pockets of light-to-moderate damage could be found at widely scattered locations across the remainder of the work area.

Population levels of this insect rise dramatically every 9 to 10 years and last from 3 to 4 years. The previous infestation started in 1981 and ended by 1985.

Spruce Budworm, *Choristoneura fumiferana* (Clem.)

A further increase occurred in the area affected by the spruce budworm, from 6,239,636 ha in 1989 to 6,780,446 ha in 1990. The majority of the damage is in the North Central and Northwestern regions, although new infestations were detected in Hearst District of Northern Region (6,392 ha) and Algonquin Park District of Algonquin Region (2,815 ha) (Fig. 1).

The new area of infestation in Northern Region is located in the central portion of Hearst District, where aerial sketch-mapping detected a 6,392-ha infestation in portions of four townships around Nagagamisis Provincial Park. This is the first damage aerially sketch-mapped since 1986, when a major infestation that started in 1967 collapsed (Fig. 2).

Early-spring branch sampling revealed an average of 14 larvae per 45-cm tip on white spruce (*Picea glauca* [Moench] Voss) in the area mapped from the air. Sampling of balsam fir (*Abies balsamea* [L.] Mill.) in the Oba area revealed an average of 13 to 16 larvae per branch tip, but this area was not as heavily defoliated. Low counts of larvae were recorded in Ivanhoe Township, Chapleau District.

Young black spruce (*Picea mariana* [Mill.] B.S.P.) and white spruce plantations in the southwestern portion of Hearst District were examined for feeding damage. Small numbers of larvae caused trace levels of defoliation on 52% of the 2.2-m-tall white spruce in Chelsea Township, on 36.7% of the 0.9-m-tall white spruce in Ermine Township, and on 21.3% of the 0.9-m-tall black spruce in Farquhar Township.

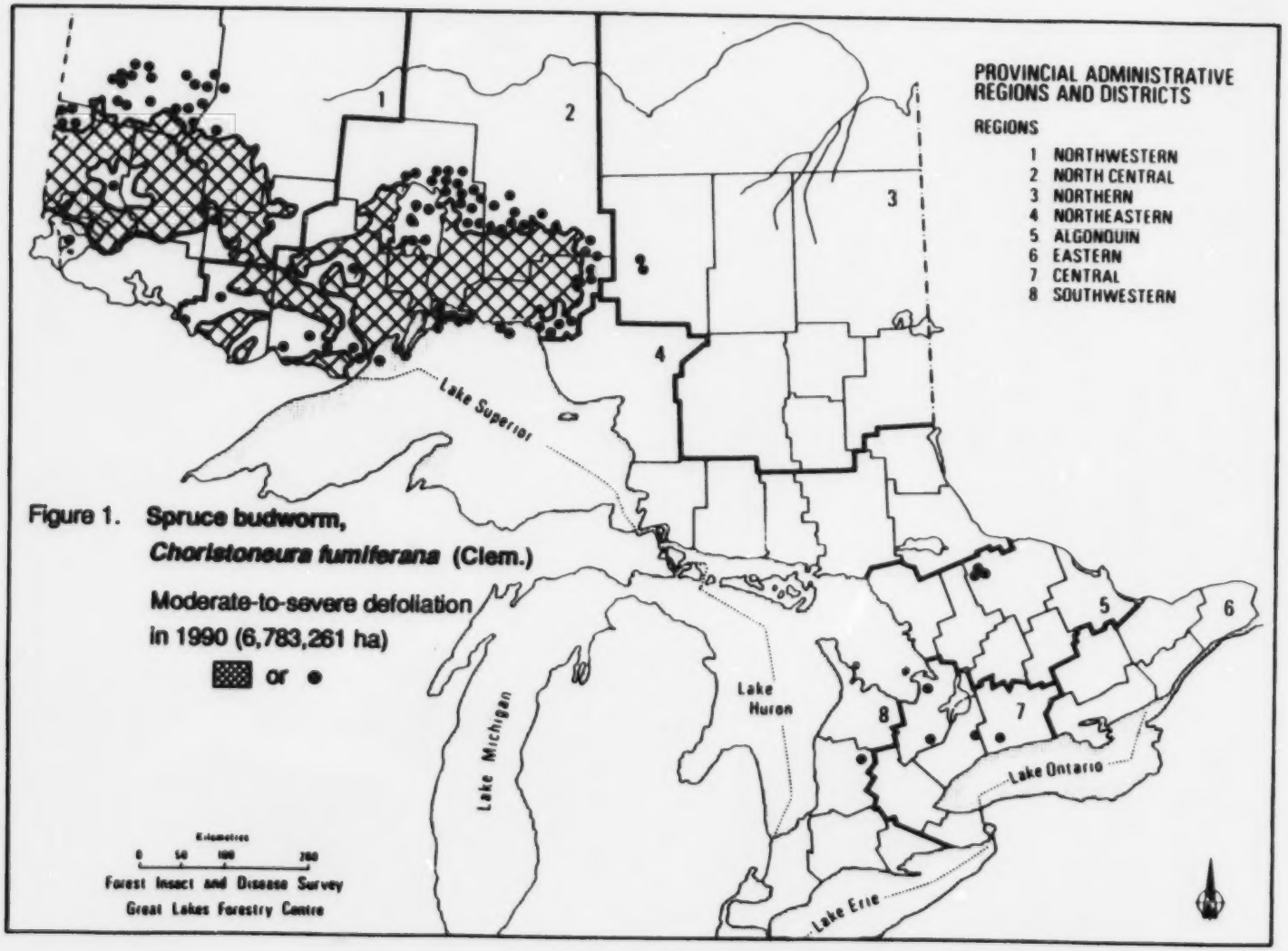


Figure 1. Spruce budworm, *Choristoneura fumiferana* (Clem.)

NORTHERN REGION

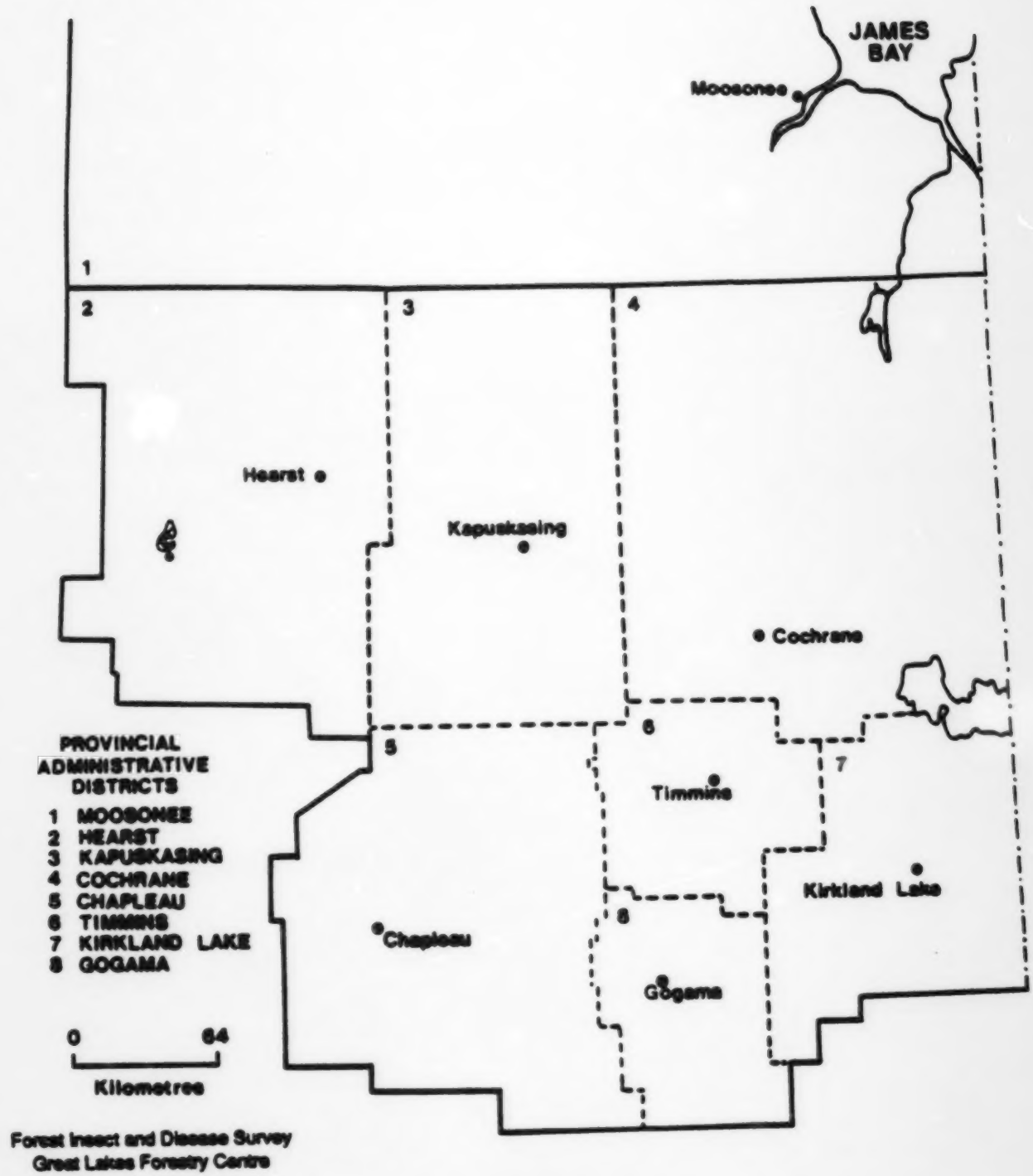


Figure 2. Spruce budworm, *Choristoneura fumiferana* (Clem.)

Areas within which moderate-to-severe defoliation occurred in 1990 ▩ or ●

Pheromone trapping was continued in impact plots and at selected locations this season using Bio-lure traps. An increase in the number of captured moths occurred in the Hearst and Kapuskasing districts (Table 1).

Table 1. Captures of male spruce budworm moths in pheromone traps in six districts of the Northern Region of Ontario, 1989-1990 (three traps at each location).

Location (Twp)	Total moths captured	
	1989	1990
Chapleau District		
Neelands	6	15
Peters	19	31
Cochrane District		
St. John	26	46
Gogama District		
Dublin	16	15[a]
Hearst District		
Frost	188	752
Larkin	156	243
Kapuskasing District		
Fauquier	20	43
Guilfoyle	23	33
Kirkland Lake District		
Maisonville	7	15
Pacaud	4	37

[a] One trap was missing at this location.

Light traps were operated in the Chapleau and Kapuskasing districts. A marked increase in catches of spruce budworm moths took place in Kapuskasing District and a slight decrease occurred in Chapleau District. Results are summarized for the past 2 years in Table 2.

Egg-mass sampling was carried out at 46 locations across the Region and the results indicate that there will be substantial population increases in Hearst District and a slight increase in the Kapuskasing, Kirkland Lake and Timmins districts. A slight decrease took place in the Chapleau and Cochrane districts (Table 3).

Table 2. Captures of spruce budworm moths in light traps at two locations in the Northern Region of Ontario in 1989 and 1990.

Location	Total number of moths captured	
	1989	1990
Chapleau District		
Chapleau Nursery	182	159
Kapuskasing District		
Remi Lake	75	352

Table 3. Northern Region - Spruce Budworm: Summary of defoliation estimates and egg-mass counts in 1990, and infestation forecasts for 1991.

Location	Host	Estimated defoliation in 1990 (%)	No. of egg masses per 9.29 m² of foliage	Infestation forecasts for 1991[a]	Accumulated damage[b]
Chapleau District					
Borden Twp	bF	0	0	0	0
Ivanhoe Twp	bF	3	0	0	0
Neelands Twp					
- Impact Plot	bF	0	0	0	0
Peters Twp					
- Shoals Prov. Pk	bF	4	32	L-M	0
Racine Twp	bF	1	0	0	0
Reaney Twp					
- Five Mile Prov. Pk	bF	0	0	0	0
Cochrane District					
Clute Twp - OMNR SPA[c]	wS	1	0	0	0
Fournier Twp					
- OMNR SPA[c]	wS	0	0	0	0
Laughton Twp	bF	0	0	0	0
Marathon Twp	bF	0	0	0	0
St. John Twp					
- Stand 177	bF	0	0	0	0
Gogama District					
Dublin Twp	bF	0	0	0	0
Garvey Twp	bF	0	0	0	0
St. Louis Twp	wS	1	0	0	0

(cont'd)

Table 3. Northern Region - Spruce Budworm: Summary of defoliation estimates and egg-mass counts in 1990, and infestation forecasts for 1991 (cont'd).

Location	Host	Estimated defoliation in 1990 (%)	No. of egg masses per 9.29 m² of foliage	Infestation forecasts for 1991[a]	Accumulated damage[b]
Hearst District					
Arnott Twp	bF	10	125	M-S	0
Breckenridge Twp	wS	36	148	M-S	0
Chelsea Twp	bF	5	30	L-M	0
Elgie Twp	bF	2	44	L-M	0
Ermine Twp	wS	39	299	S	0
Foch Twp	wS	47	937	S	1
Franz Twp	bF	2	77	M-S	0
Frost Twp					
- Nagagamisis Prov. Pk Campground	bF	18	220	S	0
- Impact Plot	bF	7	45	L-M	0
	wS	12	261	S	0
Fushimi Twp					
- Fushimi Prov. Pk	bF	12	597	S	0
Gourlay Twp	bF	5	31	L-M	0
Kohler Twp	bF	8	99	M-S	0
Larkin Twp					
- Impact Plot	bF	1	73	M-S	0
Lessard Twp - Stand 341	bF	6	93	M-S	0
Lizar Twp	wS	2	0	0	0
McEwing Twp	bF	2	25	L-M	0
Mulloy Twp	wS	3	58	M-S	0
Rogers Twp					
- Plantation 26A	bF	5	190	M-S	0
	wS	12	109	M-S	0
Shuel Twp	wS	5	188	M-S	0
Studholme Twp	wS	5	85	M-S	0
Walls Twp	wS	1	5	L	0
Wickstead Twp	wS	28	267	S	0
Kapuskasing District					
Cumming Twp	wS	1	32	L-M	0
Fauquier Twp					
- René Brunelle Prov. Pk	bF	0	0	0	0
Guilfoyle Twp	bF	0	45	L-M	0
Kirkland Lake District					
Lamplugh Twp	bF	0	0	0	0
Maisonville Twp	bF	0	0	0	0
Pacaud Twp	bF	0	4	L	0

(cont'd)

Table 3. Northern Region - Spruce Budworm: Summary of defoliation estimates and egg-mass counts in 1990, and infestation forecasts for 1991 (concl.).

Location	Host	Estimated defoliation in 1990 (%)	No. of egg masses per 9.29 m² of foliage	Infestation forecasts for 1991[a]	Accumulated damage[b]
Timmins District					
Hassard Twp	bF	0	0	0	0
Thomas Twp	wS	0	13	L-M	0

[a] S = severe, M = moderate, L = light, 0 = nil

[b] 0 = undamaged, 1 = light damage (<25% defoliation, usually one season of severe defoliation)

[c] SPA = Seed Production Area

Eastern Pine Shoot Borer, *Eucosma gloriola* Heinr.

Population levels of this pest of jack pine (*Pinus banksiana* Lamb.) increased substantially in the eastern portion of the Region in the Kirkland Lake and Timmins districts, whereas there was a decline in the Chapleau and Gogama districts. The heaviest damage occurred in Flavelle Township, Kirkland Lake District, where 26.7% of the 1.8-m trees in a 20-ha plantation were affected, with 8.7% of the leaders damaged (Table 4). A tree is considered to be severely damaged when the leader is affected.

Birch Leafminer, *Fenusa pusilla* (Lep.)

An increase in population levels of the birch leafminer occurred in the Timmins and Kirkland Lake districts. Defoliation averaging 50 to 100% was common, with areas of up to 2 ha affected. Population levels in the Hearst, Kapuskasing and Cochrane districts did not seem to be as high as those recorded in previous years. However, there were still a few small pockets with severe defoliation. As usual, ornamental white birch trees up to 15 m tall with various degrees of damage were commonly observed across the entire work area.

Forest Tent Caterpillar, *Malacosoma disstria* Hbn.

A sixfold increase in the area of moderate-to-severe defoliation by this insect was recorded across the Region in 1990. In all, 921,993 ha were infested versus 157,921 ha in 1989 (Table 5).

Table 4. Damage caused by the eastern pine shoot borer in jack pine plantations in the Northern Region of Ontario in 1990 (counts based on an examination of 150 randomly selected trees at each location).

Location (Twp)	Avg. ht. of trees (m)	Estimated no. of trees per ha	Estimated area affected (ha)	Trees affected (%)	Leaders attacked (%)
Chapleau District					
Arbutus	1.4	2,500	50	2.7	2.7
Carty	2.1	2,500	120	2.7	1.3
Caverly	1.3	2,500	6	4.0	2.7
Copperfield	2.5	2,500	60	10.0	6.0
Dalmas (Island Lk TIA)[a]	1.9	2,500	12	1.3	1.3
D'Arcy	2.8	2,500	100	2.0	2.0
McNaught	1.9	2,500	65	2.0	1.3
Sadler	2.7	1,500	120	4.0	2.0
Strom	2.4	2,500	10	3.3	3.3
Cochrane District					
Kennedy[b]	1.2	2,100	1	4.7	0
Gogama District					
Garibaldi	2.4	1,500	200	4.0	2.7
Vrooman	2.2	2,500	75	2.7	2.0
Kirkland Lake District					
Cairo	1.6	4,200	20	2.0	2.0
Catharine	2.1	3,780	10	17.3	7.3
Flavelle	1.8	2,450	12	26.7	8.7
Flavelle	2.2	2,450	12	29.3	6.0
Nordica	2.1	3,360	40	15.3	3.3
Playfair	0.9	2,500	20	3.3	2.7
Timmins District					
Macklem	1.4	4,000	20	15.3	8.7

[a] Tree Improvement Area
[b] At this location, Scots pine (*Pinus sylvestris* L.) was the host.

The majority of the infestation was confined to trembling aspen (*Populus tremuloides* Michx.) throughout the central portions of the Hearst and Kapuskasing districts and north into Moosonee District, along the Kabinakagami and Kenogami river systems. Two large areas of infestation were also recorded in the southwestern corner of Hearst District; these extended northward from the Geraldton infestation. A small infestation was also recorded in Timmins District near the city of Timmins (Fig. 3).

Table 5. Defoliation by the forest tent caterpillar in the Northern Region of Ontario in 1989 and 1990.

District	Defoliation (ha) 1989	1990	Change (ha)
Hearst	150,439	789,396	+638,957
Kapuskasing	7,482	85,981	+78,499
Moosonee	0	46,446	+46,446
Timmins	0	170	+170
Total	157,921	921,993	+764,072

The main area of the infestation extended east along Highway 11 from the Geraldton-Hearst district boundary to the town of Opasatika, in a strip approximately three townships deep to the south of the highway; the infestation also extended through the town of Hale along the Algoma Central Railway in Templeton Township. North of Highway 11, all available host trees along the Missinaibi, Kabinakagami and Kenogami rivers were affected as far north as the junction of the Kenogami and Albany rivers.

Numerous pockets of defoliation were recorded ahead of the main body of the infestation, particularly in the area southwest of Hornepayne, where the infestation is entering Hearst District from Wawa District.

In Timmins District, the area infested was confined to a single township near the city of Timmins, near the junction of Highway 11 and the Kamiskotia Mine Road.

The infestation predicted for Chapleau District in 1990 failed to materialize due to a combination of heavy egg parasitism and late-spring frosts; however, small larval populations remained in the area.

Extensive egg-band sampling across the infested areas of the Region (Table 6) detected the possibility of an extensive expansion in both the Kapuskasing and Hearst districts, possibly joining with the Geraldton and Hearst infestation and expanding north of the Kapuskasing area into Garden and Hambly townships.

At other sample locations, expansion of the infestation should be slight, as the number of egg bands has not increased greatly since 1989 (Fig. 4).

Elsewhere in the Region, observations of single larvae were sporadically recorded.

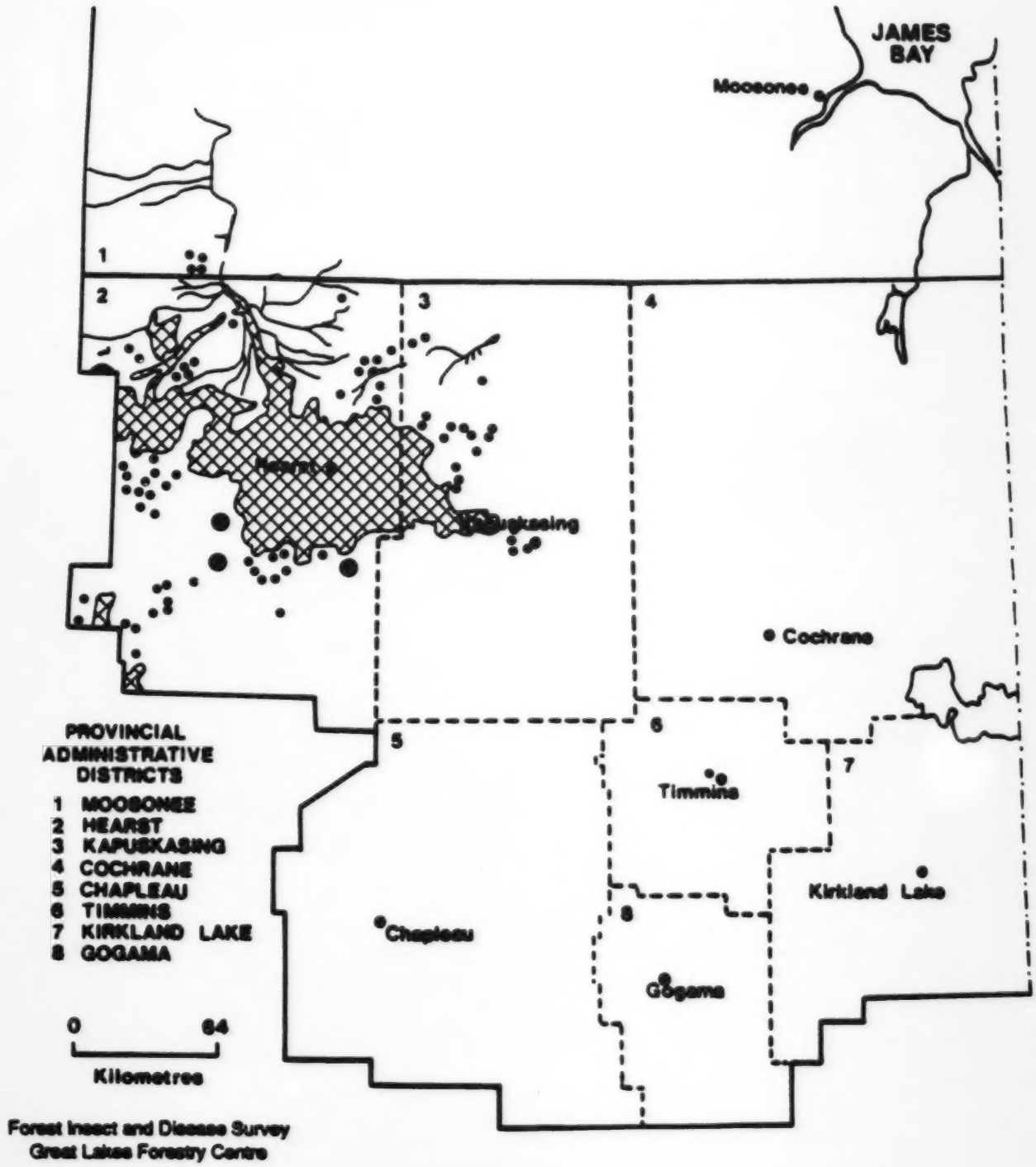


Figure 3. **Forest tent caterpillar,**
***Malacosoma disstria* (Hbn.)**

Areas within which moderate-to-severe defoliation occurred in 1990 ▩ or ●

Table 6. Forest tent caterpillar egg-band counts on trembling aspen in the Northern Region of Ontario in 1990 and infestation forecasts for 1991 (based on three trees sampled at each location).

Location (Twp)	Avg. DBH of trees (cm)	Avg. no. of egg bands per tree	Infestation forecast for 1991
Chapleau District			
Brackin	14	3.0	Moderate
Cochrane District			
Adanac	17	9.7	Moderate
Avon	17	2.3	Light
Kendrey	16	1.3	Light
Gogama District			
Dublin	13	0.0	Nil
Hearst District			
Beaton	17	12.0	Severe
Caithness	16	8.0	Moderate
Elgie	17	8.7	Moderate
Franz	16	7.3	Moderate
Fushimi	16	308.0	Severe
Kendall	16	119.0	Severe
Lowther	19	166.0	Severe
McCoig	15	30.5	Severe
McEwing	15	46.0	Severe
McMillan	15	167.0	Severe
Shannon	17	260.0	Severe
Shetland	17	33.0	Severe
Studholme	17	79.0	Severe
Woolrich	17	48.0	Severe
North of Rogers Twp	16	314.0	Severe
Kapuskasing District			
Casselman	17	0.7	Light
Eilber	16	134.0	Severe
Fauquier	17	9.3	Moderate
Guilfoyle	17	49.0	Severe
Harmon	17	3.0	Light
Opasatika	18	4.0	Light
Shackleton	16	5.7	Moderate
Shearer	16	4.7	Light
Sulman	15	2.0	Light
Teetzel	17	108.0	Severe
Williamson	17	13.0	Severe
Timmins District			
Godfrey	14	2.6	Moderate
Jessop	16	0.0	Nil
Mountjoy (Dam)	21	8.3	Moderate
Mountjoy (Radio Tower)	19	10.3	Severe
Mountjoy (Mattagami Height)	22	6.6	Moderate

NORTHERN REGION

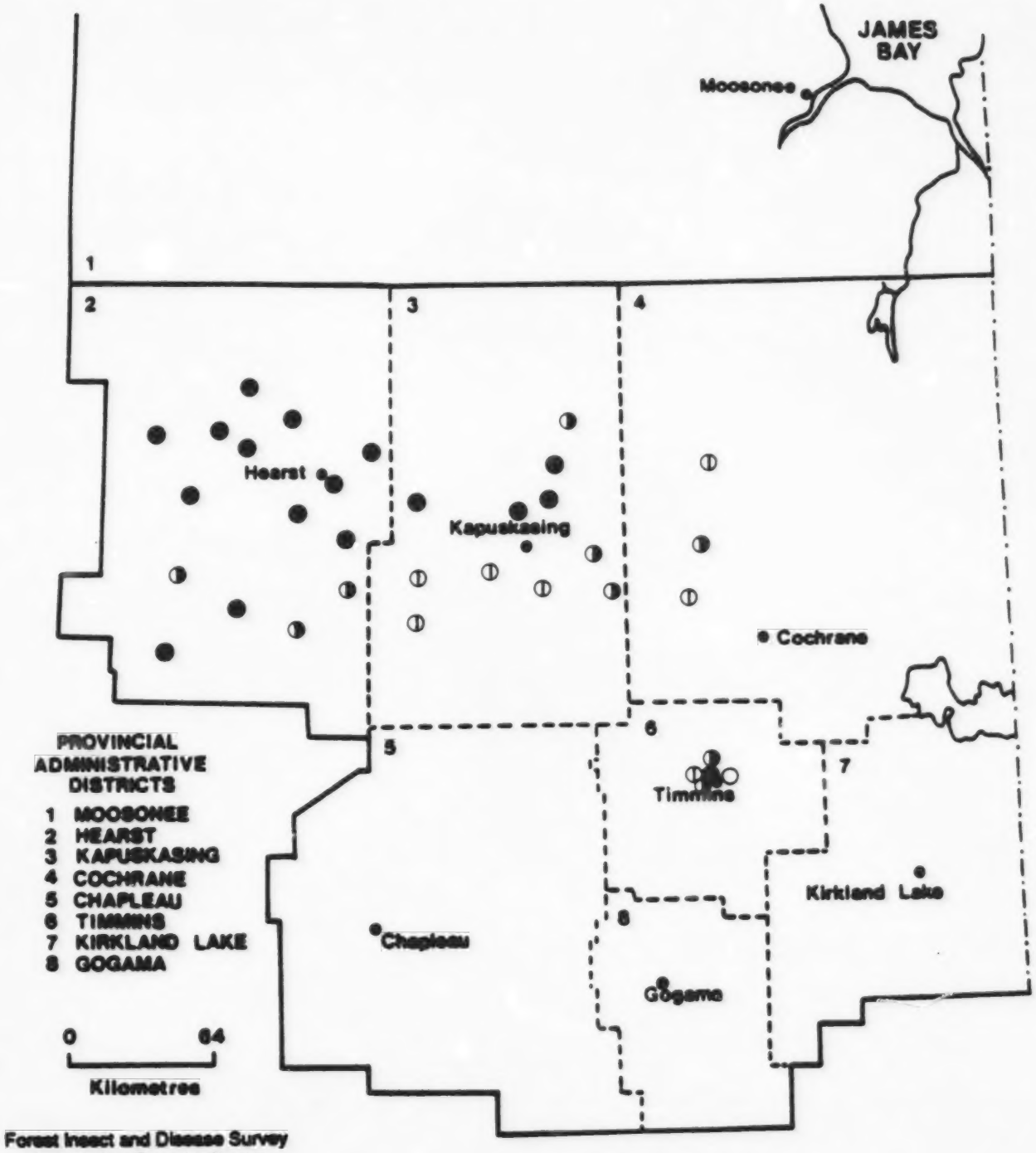


Figure 4. **Forest tent caterpillar, *Malacosoma disstria* (Hbn.)**

Locations of egg-band sampling and defoliation forecasts for 1991

severe..... ● light..... ◐
moderate..... ◑ nil..... ○

Redheaded Jack Pine Sawfly, *Neodiprion virginiana* complex

Population levels of this late-season pest of jack pine remained high in portions of the Chapleau and Gogama districts in 1990. For the second year, heavy damage was found in a 200-ha plantation in Algona Township, Chapleau District. In this 7-year-old plantation, 80% of the 1.7-m trees were affected, with an average of 45% defoliation.

For the fourth consecutive year, moderate damage occurred in a 0.5-ha area of open-growing 7-m trees in Margaret Township, Chapleau District. In this area, just north of the village of Biscotasing, 100% of the trees were affected, with an average of 20% defoliation.

Moderate damage also occurred at the Muldrew Lake boat launch, Dublin Township, Gogama District. Of the 3-m trees growing in an open 1-ha area, 70% were affected. Defoliation was 35% but damage from this insect was mixed with damage from the blackheaded jack pine sawfly (*Neodiprion pratti banksianae* Roh.), making it difficult to separate the impacts of the two insects.

Light damage was commonly found at scattered locations throughout the Chapleau, Gogama, Kirkland Lake and Timmins districts.

Yellowheaded Spruce Sawfly, *Pikonema alaskensis* Roh.

Population levels on spruce (*Picea* spp.) throughout the Region remained much the same as in previous years, with an average of 8% defoliation recorded in affected plantations and on roadside trees.

Moderate-to-severe defoliation over a 2-year period in a 4-ha plantation of 1.6-m trees in Glackmeyer Township, Cochrane District, has resulted in mortality of 1.3% of the trees. At this location, 93% of the trees sustained an average of 36.5% defoliation in 1989 and a further 68.5 to 99.3% defoliation in 1990.

Defoliation levels of 10 to 15% were recorded on open-grown trees 1 to 3 m tall in both Shoals and Ivanhoe provincial parks, Chapleau District. At these locations, the little spruce sawfly (*Pristiphora lena* Kinc.) was feeding in conjunction with the yellowheaded spruce sawfly. Similar damage levels were recorded on a 4-m spruce hedge adjacent to a transformer station in Maisonville Township, Kirkland Lake District. Here, the yellowheaded spruce sawfly was feeding in conjunction with the European spruce sawfly (*Gilpinia hercyniae* [Htg]).

Heavier (up to 100%) defoliation was recorded commonly on ornamental trees across the Region.

White Pine Weevil, *Pissodes strobi* (Peck)

The 1990 damage levels caused in young spruce and pine plantations by this late-season pest were generally similar to those found in 1989. In most instances, damage was in the light-to-moderate range. However, there were a few exceptions across the Region in which high levels of damage were found (Table 7). The highest level of damage occurred in a black spruce plantation in Bragg Township, Cochrane District, where 36.7% of the 1.6-m trees in a 5-ha area were affected.

Table 7. Damage caused by white pine weevil in the Northern Region of Ontario in 1990 (counts based on an examination of 150 randomly selected trees at each location).

Location (Twp)	Tree species	Avg. ht. of trees (m)	Estimated no. trees/ha	Estimated area affected (ha)	Trees affected (%)
Chapleau District					
Arbutus	jP	1.4	2,500	50	9.3
Carty	jP	2.1	2,500	120	4.0
Caverly	jP	1.4	1,600	6	2.0
Chappise	jp	2.2	1,500	15	2.7
Copperfield	jP	2.5	2,500	60	2.0
Dalmas					
(Island Lake TIA)[a]	bS	0.5	2,500	30	10.7
	jP	1.5	2,500	12	10.0
D'Arcy	jp	2.8	2,500	100	8.7
DeGaulle	jP	2.4	2,500	12	1.3
McNaught	jP	1.9	2,500	65	8.7
Neelands	jP	2.2	2,500	10	4.0
Nimitz	jP	2.3	2,500	100	5.3
Oates	jP	1.1	2,500	10	4.7
Sadler	jP	2.7	1,500	120	4.0
Strom	jP	2.4	2,500	10	6.7
Warren	jP	1.9	2,500	20	2.7
Cochrane District					
Bragg	bS	1.6	2,200	5	36.7
Calder	wS	3.8	2,100	10	0.7
Kennedy	ScP	1.2	2,100	1	4.0
Thorning	ws	1.4	2,200	50	8.7
Gogama District					
Garibaldi	jP	2.4	1,500	200	8.7
Vrooman	jP	2.2	2,500	75	9.3
Hearst District					
Larkin	wS	2.3	2,000	30	6.0
Pelletier	jP	3.1	2,100	20	1.3
Pelletier	bS	2.8	1,800	10	4.0

(cont'd)

Table 7. Damage caused by white pine weevil in the Northern Region of Ontario in 1990 (counts based on an examination of 150 randomly selected trees at each location) (concl.).

Location (Twp)	Tree species	Avg. ht. of trees (m)	Estimated no. trees/ha	Estimated area affected (ha)	Trees affected (%)
Kapuskasing District					
Casselman	bS	2.7	2,200	25	6.7
Hopkins	bS	1.6	2,000	100	6.7
Nansen	bS	1.0	2,100	5	2.0
Teetzel	bS	1.0	2,200	5	2.7
Kirkland Lake District					
Cairo	jP	1.6	4,200	20	14.0
Catharine	jP	2.1	3,780	10	1.3
Flavelle	jP	1.8	2,450	12	2.7
Nordica	jP	2.1	3,360	40	6.7
Timmins District					
Denton	jP	0.4	2,500	51	1.3
Denton	jP	0.6	2,500	10	2.7
Macklem	jP	1.4	4,000	20	0.7
Price	jP	0.9	4,444	20	0.7

[a] Tree Improvement Area

Early Aspen Leafcurler, *Pseudexentera oregonana* (Wlsm.)

The infestation that occurred on trembling aspen in the Matheson area of Kirkland Lake District in 1989 spread northward in 1990. Aerial mapping of the infestation established the northern boundary to be near the town of Iroquois Falls, with 16,200 ha affected in Cochrane District and 5,000 ha in the Kirkland Lake District for a total of 21,200 ha of moderate-to-severe defoliation (Fig. 5).

Small pockets of moderate-to-severe defoliation were aerially sketch-mapped around the main infestation and light defoliation was observed in scattered pockets throughout the eastern and northern portions of the Region.

The outbreak recorded in Hearst District in 1989 started out with large numbers of larvae this spring, but was overtaken by a major forest tent caterpillar infestation, which made it impossible to map damage caused only by the leafcurler.

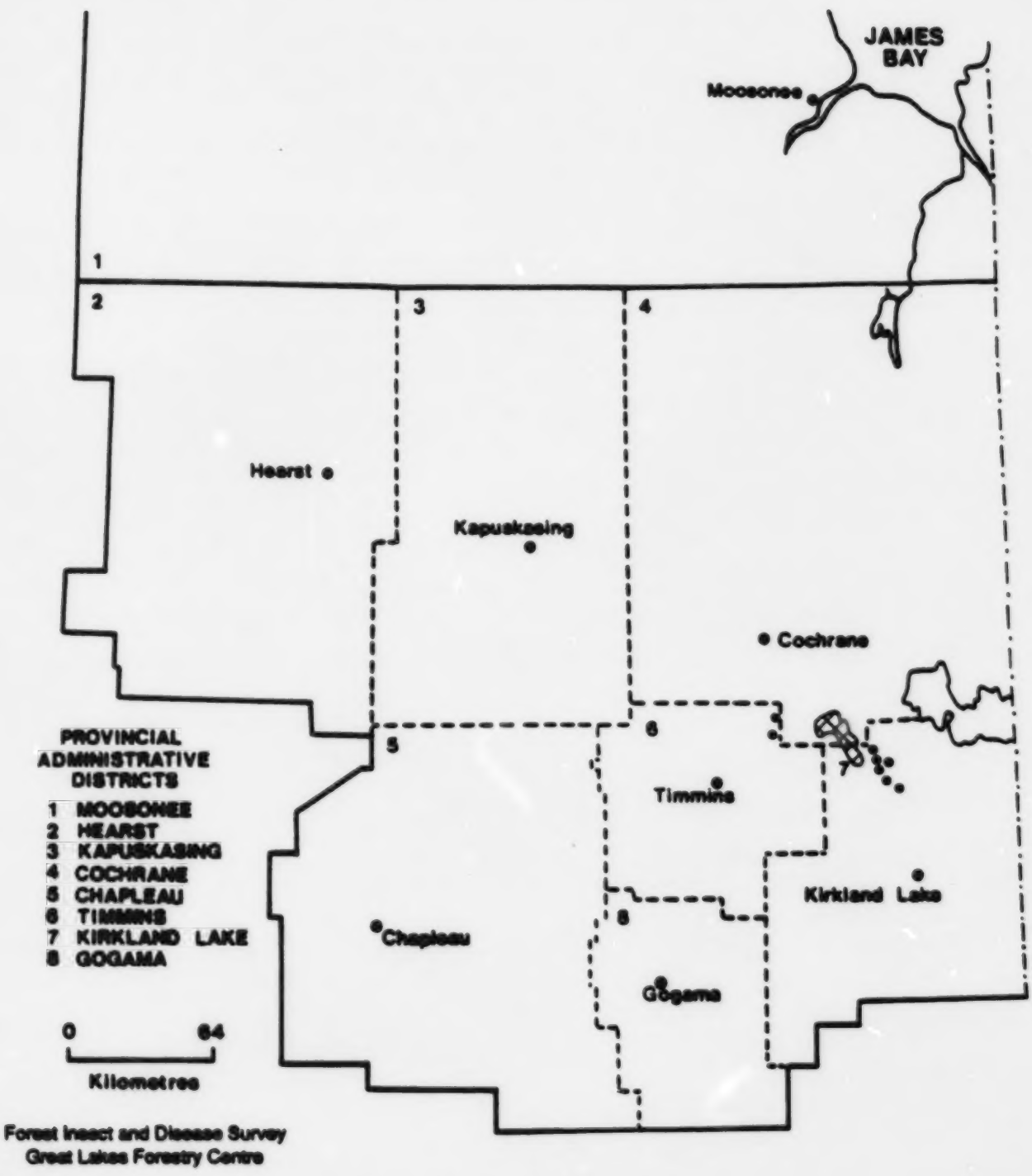


Figure 5. Early aspen leafroller, *Pseudexentera oregonana* (Wlshm.)

Areas within which moderate-to-severe defoliation occurred in 1990 ▩ or ●

Minor Insects

Jack Pine Tip Beetle, *Conophthorus resinosae* Hopk.

After heavy damage in parts of the Region in 1987 and 1988, populations of this pest declined in 1989 and 1990. Damage to jack pine occurred primarily on open-growing semimature trees. The heaviest damage occurred on a group of 10 to 12 trees growing in a 0.3-ha area adjacent to Little Wenebegon Lake, Strom Township, Chapleau District. The trees at this location had 40% of their shoots affected. This is the second consecutive year in which heavy damage has occurred. A small group of 6-m trees in a 0.2-ha area near the Wakami Dam, Wakami Township, Chapleau District, were also attacked, and 55% of the shoots were damaged. In a 1-ha plantation in McEwing Township, Hearst District, 1.3% of the 2-m trees were lightly damaged. In a 2-ha plantation in Stoddart Township, Heart District, 0.7% of the trees were lightly damaged. These two examples are representative of damage to plantations in the Region.

Northern Pitch Twig Moth, *Petrova albicapitana* (Bsk.)

Evaluations conducted at 14 locations across the work area revealed that an average of 6.9% of the trees examined had sustained damage from this insect (Table 8). The heaviest damage was in a 4-ha area of 2.8-m trees in Macklem Twp, Timmins District, where 12.0% of the trees were affected. Of these, 6.7% had main-stem infections that could result in serious quality problems in the tree at harvest. However, the damage was confined to side branches in most instances and little or no current branch mortality was recorded.

Table 8. Damage by the northern pitch twig moth in four districts of the Northern Region of Ontario in 1990 (counts based on an examination of 150 randomly selected jack pine trees at each location).

Location (Twp)	Avg. ht. of trees (m)	Estimated no. of trees per ha	Estimated area affected (ha)	Trees affected (%)	
				Side branches	Main stem
Cochrane District					
Kennedy	1.6	2,100	1	10.7	0
Stimson	2.5	2,300	12	2.7	0
Hearst District					
Arnott	2.7	2,000	200	1.3	0
Chelsea	1.4	1,800	25	11.3	0
Elgie	0.7	1,800	150	4.7	0
McEwing	2.0	2,500	1	0.7	0
Pelletier	3.1	2,100	20	1.3	0
Stoddart	1.3	2,500	2	3.3	0

(cont'd)

Table 8. Damage by the northern pitch twig moth in four districts of the Northern Region of Ontario in 1990 (counts based on an examination of 150 randomly selected jack pine trees at each location) (concl.).

Location (Twp)	Avg. ht. of trees (m)	Estimated no. of trees per ha	Estimated area affected (ha)	Trees affected (%)	
				Side branches	Main stem
Kirkland Lake District					
Armstrong	3.8	2,200	10	12.0	0
Cairo	1.6	2,500	10	20.0	0
Chamberlain	3.3	2,500	10	1.3	0
Flavelle	1.8	2,450	12	2.7	0.7
Holloway	0.3	2,500	20	12.7	0
Timmins District					
Macklem	2.8	2,000	4	12.0	6.7

Table 9. Other forest insects.

Insect	Host(s)	Remarks
Acantholyda erythrocephala (L.) Pine false webworm	jP	Single webs were found on 1.3% of the trees in a 2-ha plantation in Stoddart Twp, Hearst District.
Acrobasis betulella Hlst. Birch tubemaker	wB	Low population levels caused trace levels of defoliation in Frost Twp, Hearst District.
Altica ambiens ambiens Lec. Alder flea beetle	Al	Defoliation averaged 75% throughout Denton, Carnegie, Hassard, and Timmins twps, Timmins District, and Cairo and Powell twps, Kirkland Lake District; 80% defoliation occurred on 2.5-m bushes in a 2-ha area, Collins Twp, Chapleau District.
Aphrophora cribrata (Wlk.) Pine spittlebug	jP	45% of the 1.8-m trees surveyed were infested in a 25-ha plantation, Chelsea Twp, Hearst District; 45% of the 2-m trees were infested in a 10-ha area, Flavelle Twp, Kirkland Lake District; moderate population levels were found throughout the Region.

(cont'd)

Table 9. Other forest insects (cont'd).

Insect	Host(s)	Remarks
Aphrophora saratogensis (Fitch) Saratoga spittlebug	jP	Low adult population levels were recorded on 16-m trees throughout the acid rain plot in Cane Twp, Kirkland Lake District.
Archips cerasivorana (Fitch) Uglynest caterpillar	cC, Al	Light damage was recorded at a a number of locations on roadside and open-grown shrubs throughout the district. The heaviest damage occurred in Cavell Twp, Chapleau District, where a 6-ha field of cherry was 75% defoliated.
Cecidomyia resinicola (O.S.) Jack pine resin midge	jP	Trace levels of damage occurred on 29.3% of the 2.5-m trees in a 12-ha plantation in Stimson Twp, Cochrane District.
Cephalcia sp. Webspinning sawfly	jP	Trace levels of defoliation were recorded on 2-m trees in plantations up to 10 ha in size in Stock Twp, Timmins District, and McNeil Twp, Kirkland Lake District.
Coleophora laricella (Hbn.) Larch casebearer	tL	Small populations (4 to 5 insects per 45-cm branch tip) were recorded on mature trees over areas of from 0.1 to 5 ha in Daoust Twp, Chapleau District, and Chamberlain Twp, Kirkland Lake District.
Dioryctria abietivorella (Grt.) Fir coneworm	jP	Damage by this insect was recorded on 4% of the cones collected from the 10-ha orchard of 3.5-m trees at Aidie Creek, Chamberlain Twp, Kirkland Lake District.
Eupareophora parca (Cress.) Spiny ash sawfly	black ash	An average of 35% defoliation occurred on semimature and mature trees in a 10-ha stand, Birch Twp, Chapleau District.

(cont'd)

Table 9. Other forest insects (cont'd).

Insect	Host(s)	Remarks
Exoteleia dodecella (L.) Pine bud moth	jP	16.7% of the 2-m trees in a 1-ha plantation had 1 to 3 lateral branches affected in McEwing Twp, Hearst District.
Gonioctena americana (Schaeff.) American aspen beetle	tA	Moderate-to-severe (50-80%) defoliation appeared commonly in young aspen stands throughout the Chapleau and Gogama districts.
Hylobius warreni Wood Warren's root collar weevil	jP, ScP	2% mortality occurred and another 2.7% of the trees were attacked in a 1.2-m-tall jack pine and Scots pine, 1-ha plantation in Kennedy Twp, Cochrane District; trace levels were observed killing trees in Potter and Dempsay twps, Cochrane District.
Hyphantria cunea (Drury) Fall webworm	hard-woods	Small populations were recorded in the southern portion of Kirkland Lake District in the farming areas bounded by Earlton, Charlton and Englehart.
Lasiomma anthracinum (Czerny) Spruce cone maggot	wS	found in conjunction with fir coneworm and spruce seed moth (*Cydia strobilella* [L.]) causing 5% damage to heavy cone production on the windbreak adjacent to Compartment H19 in the Swastika Nursery, Burt Twp, Kirkland Lake District.
Malacosoma californicum pluviale Dyar Northern tent caterpillar	pcH, wB, tA, W	Large populations caused 75 to 90% defoliation of roadside bushes, Lipsett Twp, Chapleau District; moderate levels were found throughout the Chapleau and Gogama districts.
Neodiprion abietis complex Balsam fir sawfly	bF	10% defoliation to 1- to 2-m regeneration trees in a 0.2-ha area, Ivanhoe Twp, Chapleau District; similar levels of damage to mature trees, Mountjoy Twp, Timmins District

(cont'd)

Table 9. Other forest insects (cont'd).

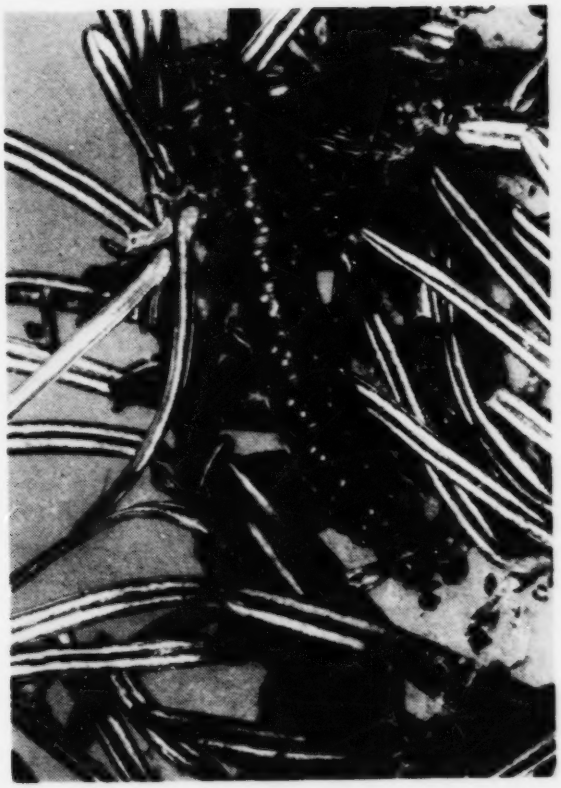
Insect	Host(s)	Remarks
Neodiprion maurus Roh. Pine sawfly	jP	5% defoliation occurred on 1.3% of the 1.3-m trees in a 2-ha plantation in Stoddart Twp, Hearst District.
Neodiprion nanulus nanulus Schedl. Red pine sawfly	jP	25% of semimature ornamental trees in the town of Chapleau were affected, with an average defoliation of 20%; 70% of open-growing, waterfront trees were affected, with 20% defoliation, in Wakami Lake Provincial Park, Chapleau District
Neodiprion pratti banksianae Roh. Jack pine sawfly	jP	Light defoliation (approximately 20%) was recorded on mature trees at a number of locations in and around the town of Chapleau; in Shoals and Wakami provincial parks, Chapleau District; and on several 2-m trees along a bush road adjacent to the Negagamasis River in McMillan Twp, Hearst District.
Neodiprion swainei Midd. Swaine jack pine sawfly	jP	Trace populations were observed in plantations and on open-grown mature trees north of Tretheway Lake, Corkill Twp, Kirkland Lake District.
Phyllonorycter kenora (Free.) Willow leafblotch miner	W	Pockets of 100% defoliation over areas of up to 2 ha were recorded on 2- to 4-m shrubs adjacent to roadsides throughout the Kapuskasing, Hearst, Cochrane and Kirkland Lake districts.
Phyllonorycter nipigon (Free.) Balsam poplar leafblotch miner	bPo	Stands of mature trees up to 15 ha in size were severely (100%) damaged across the Kapuskasing, Hearst and Cochrane districts.
Phyllonorycter ontario (Free.) Aspen leafblotch miner	tA	Severe (60-100%) defoliation was recorded in natural stands of aspen over areas of from 2 to 5 ha in size throughout the Hearst, Timmins and Kirkland Lake districts.

(cont'd)

Table 9. Other forest insects (concl.).

Insect	Host(s)	Remarks
Pristiphora erichsonii (Htg.) Larch sawfly	tL	Young regeneration over a 0.1-ha area of 2.5-m trees in Hassard Twp, Timmins District, sustained an average of 5% defoliation.
Pristiphora geniculata (Htg.) Mountain-ash sawfly	AMo	50 to 100% defoliation found on scattered trees, Mountjoy Twp, Timmins District, in the town of Chapleau and across Hearst District
Psylla floccosa (Patch) False woolly alder aphid and *Prociphilus tessellatus* (Fitch) Woolly alder aphid	Al	Alder clumps throughout Kirkland Lake District, specifically in the Kirkland Lake-Elk Lake-Matachewan area, supported heavy populations of both aphids. Areas of damage ranged from 0.1 to 0.5 ha in size on shrubs from 2 to 4 m in height.
Pyrrhia exprimens (Wlk.) Variable caterpillar	ground vegetation	light damage to herbaceous ground plants in prescribed burns from previous years in the northern portion of the Region, but no damage to tree seedlings
Rhabdophaga swainei Felt Spruce bud midge	bS	Trace population levels were observed causing up to 3% bud damage across the northern half of the Region.
Rheumaptera hastata (L.) Spearmarked black moth	wB	6% of the trees had up to 5% defoliation in a mature experimental stand along the Detour Lake Rd, Cochrane District.
Tetralopha aplastella (Hlst.) Aspen webworm	tA	Damage of approximately 30% was observed over a 1-ha area of 2.5-m trees in a large cutover area in Macklem Twp, Timmins District.
Toumeyella parvicornis (Ckll.) Pine tortoise scale	jP	Heavy, single-tree damage was recorded sporadically throughout a 20-ha plantation of 0.3-m trees in Holloway Twp, Kirkland Lake District.

Redheaded jack pine sawfly (*Neodiprion virginianus* complex)



Spruce budworm (*Choristoneura fumiferana* Clem.) feeding

White spruce severely defoliated by the yellowheaded spruce sawfly (*Pikonema alaskensis* [Roh.])

Spruce needle rust (*Chrysomyxa ledi* or *C. ledicola*)

White pine blister rust (*Cronartium ribicola* J.C. Fischer)

Pine needle rust (*Coleosporium asterum* [Dietel] Sydow)

TREE DISEASES

Major Diseases

Armillaria Root Rot, *Armillaria ostoyae* (Romagn.) Herink

Low levels of mortality due to this organism were recorded again this year in young coniferous plantations and natural regeneration throughout the Region. The highest mortality rate in jack pine plantations was 3.0% in Horwood and Ivy townships, Chapleau District. Because jack pine had the most damage, we expanded our efforts on this species, resulting in the 20 evaluations summarized in Table 10. The most damage to white spruce was 1.3% mortality in Larkin Township, Hearst District. Similar damage levels were recorded in two black spruce areas, one in Bragg Township, Cochrane District, and the other in Hopkins Township, Kapuskasing District.

Table 10. Jack pine mortality caused by Armillaria root rot in the Northern Region of Ontario in 1990 (counts based on an examination of 150 randomly selected trees at each location).

Location (Twp)	Avg. ht. of trees (m)	Estimated no. of trees per ha	Estimated area affected (ha)	Current mortality (%)
Chapleau District				
Carty	2.1	2,500	120	1.3
Horwood	0.7	4,444	10	3.0
Ivy (north)	0.5	4,444	100	3.0
Ivy (south)	1.0	2,500	25	2.0
McNaught	1.9	2,500	65	0.7
Gogama District				
Invergarry	1.6	2,500	12	1.3
Vrooman	2.2	2,500	75	1.3
Hearst District				
Elgie	0.7	1,800	150	0.7
McEwing	2.0	2,500	1	0.7
Pelletier	3.1	2,100	20	1.3
Kirkland Lake District				
Cairo	1.6	4,200	20	1.3
Catharine	2.1	3,700	10	0.7
Chamberlain	3.7	2,500	10	0.7
Flavelle	1.8	2,450	10	0.7
Flavelle	2.2	3,600	20	2.7
McGarry	2.0	4,200	5	1.6
Playfair	0.9	2,500	20	0.7
Playfair	1.5	2,500	5	0.7
Timmins District				
Macklem	1.4	2,500	20	0.7
Price	0.9	4,400	20	1.3

Scleroderris Canker, *Ascocalyx abietina* (Lagerb.) Schläpfer-Bernhard

Periodic outbreaks of this destructive organism can devastate young jack pine and red pine (*Pinus resinosa* Ait.) plantations and natural regeneration. Evaluations revealed that this organism caused 58% mortality and infected another 20% of the remaining trees in a 2-ha pocket within a 200-ha plantation in Reaney Township, Chapleau District. A sanitation cut and burn operation in the infected area was carried out by OMNR personnel in an attempt to keep the disease from spreading.

Elsewhere in the Region, an extensive cutover area in Warden Township, Kirkland Lake District, has now been planted with jack pine, but some residual trees in the area were infected with this disease and present a potential threat to the new trees. Young red pine in lowlying portions of the Aide Creek Seed Orchard in Chamberlain Township, Kirkland Lake District, displayed symptoms of damage by this organism. Trace levels of damage occurred in Stimson Township, Cochrane District.

Spruce Needle Rusts, *Chrysomyxa ledi* (Alb. & Schwein.) de Bary var. *ledi*
Chrysomyxa ledicola (Peck) Lagerh.

The general distribution and abundance of these organisms were unusually high across the northern portion of the Region. The incidence of these diseases in natural stands and young plantations, though high, resulted in low-to-moderate damage levels in most instances (Table 11). The heaviest damage was confined to small, low, wet areas of black spruce swamp across the northern portion of the Kirkland Lake and Timmins districts.

Table 11. Damage caused by spruce needle rusts in the Northern Region of Ontario in 1990 (counts based on an examination of 150 randomly selected trees at each location).

Location (Twp)	Tree species	Avg. ht. of trees (m)	Estimated no. of trees/ha	Estimated area affected (ha)	Trees affected (%)	Foliar damage (%)
Chapleau District						
Marshall	wS	1.9	2,500	50	13	4
Panet	bS	6.0	1,500	10	67	15
Cochrane District						
Bragg	bS[a]	1.6	2,200	5	99	15
Calder	wS	3.8	2,100	10	100	16
Glackmeyer	wS	1.6	2,500	4	27	2
Kennedy	bS[a]	0.7	2,400	20	98	34
Mann	bS	0.3	2,500	5	58	7
Mewhinney	bS	0.2	2,200	5	9	2
Thorning	wS[a]	1.4	2,200	50	100	23
Tweed	bS	0.3	2,300	5	6	2

(cont'd)

Table 11. Damage caused by spruce needle rusts in the Northern Region of Ontario in 1990 (counts based on an examination of 150 randomly selected trees at each location) (concl.).

Location (Twp)	Tree species	Avg. ht. of trees (m)	Estimated no. of trees/ha	Estimated area affected (ha)	Trees affected (%)	Foliar damage (%)
Hearst District						
Chelsea	wS	2.2	2,200	280	100	2
Ermine	wS	0.9	1,800	300	39	2
Hawkins	wS	0.9	2,000	20	21	2
Larkin	wS[a]	2.3	2,000	30	99	19
Pelletier	bS[a]	2.8	1,800	10	100	2
Stoddart	bS	0.5	2,500	2	16	2
Kapuskasing District						
Casselman	bS	2.7	2,200	25	100	2
Hopkins	bS[a]	1.6	2,000	100	100	16
Nansen	bS	1.0	2,100	5	49	2
Teetzel	bS	1.0	2,200	5	89	2
Kirkland Lake District						
Burt	bS	6.0	4,000	2	100	60
Chamberlain	bS	1.1	2,500	13	50	1
Harker	bS	5.0	4,000	8	100	50
Ingram	bS	2.0	4,000	3	100	35
Timmins District						
Carnegie	bS	11.0	4,000	5	100	52
Denton	bS	0.4	2,500	10	7	1

[a] Location at which the parasitic fungi were also found

Areas of repeated attack by these diseases in the Cochrane and Kapuskasing districts were unusual in that a parasitic fungus has been found in association with this organism and, in some cases, the parasite appears to have reduced the availability of inoculum for further infection (Table 12). Another observation in these areas was that the black spruce hosts usually attacked in the mixed black spruce/white spruce stands (and which exhibited heavy parasitic fungus infections last year) was relatively free of damage. However, the white spruce component exhibited populations of both the needle rust and the parasitic fungi in proportions similar to those on black spruce the previous year.

Table 12. A comparison of three areas of heavy incidence of spruce needle rusts that have been affected by a parasitic fungus for the past 2 years.

Location (Twp)	Trees affected (%)		Foliar damage (%)		Trees with parasitic fungi (%)	
	1989	1990	1989	1990	1989	1990
Cochrane District						
Bragg	100	98.7	25.0	15.0	8.0	98.7
Thorning	100	100.0	22.0	1.0	95.0	0
Kapuskasing District						
Hopkins	100	100.0	16.7	16.0	66.7	98.7

Pine Needle Rust, *Coleosporium asterum* (Dietel) Sydow

In 1990, levels of this foliar disease were similar to those in 1989. Light damage was commonly found in the majority of jack pine plantations surveyed. The heaviest damage was found in a 130-ha plantation in Sadler Township, Chapleau District, where 75% of the 1.0-m trees were affected, with an average of 25% foliar damage (Table 13).

Table 13. Damage caused by pine needle rust to jack pine in the Northern Region of Ontario in 1990 (counts based on an examination of 150 randomly selected trees at each location).

Location (Twp)	Avg. ht. of trees (m)	Estimated no. of trees per ha	Estimated area affected (ha)	Trees affected (%)	Foliar damage (%)
Chapleau District					
Alcona	0.5	2,500	30	65	7
Carty	2.0	2,500	120	75	15
Copperfield	2.0	1,500	30	40	16
Cortez	1.0	2,500	12	27	10
D'Arcy	1.0	2,500	50	65	25
Fawn	1.5	1,500	10	95	20
Horwood	0.6	4,444	15	70	15
Ivy	1.0	2,500	100	12	5
Marshall	2.0	2,500	60	50	10
Oates	0.8	2,500	10	73	20
Reaney	0.5	2,500	65	67	25
Sadler	1.0	4,444	130	75	25
Whigham	0.2	4,444	75	45	7

(cont'd)

Table 13. Damage caused by pine needle rust to jack pine in the Northern Region of Ontario in 1990 (counts based on an examination of 150 randomly selected trees at each location) (concl.).

Location (Twp)	Avg. ht. of trees (m)	Estimated no. of trees per ha	Estimated area affected (ha)	Trees affected (%)	Foliar damage (%)
Gogama District					
MacMurchy	1.0	2,500	75	99	12
Hearst District					
Arnott	2.7	2,000	200	98	5
Chelsea	1.8	1,800	25	99	16
Elgie	0.7	1,800	150	27	2
McEwing	2.0	2,500	1	25	2
Stoddart	1.3	2,500	2	57	2
Kirkland Lake District					
Armstrong	3.8	2,222	10	11	6
Chamberlain	3.3	2,500	10	28	3
McGarry	2.0	4,222	8	4	3
Ossian	0.6	2,475	5	23	2

This needle rust requires an alternate host to complete its life cycle. Jack pine is the primary host, and aster (*Aster* spp.) and goldenrod (*Solidago* spp.) are the alternate hosts. The disease causes premature loss of the previous year's foliage, which can retard a young tree's development.

Sweetfern Blister Rust, *Cronartium comptoniae* Arthur

Infection levels of this disease in jack pine plantations remained the same as in previous years. Low levels were found in the majority of the plantations surveyed in the Chapleau, Gogama, Kirkland Lake and Timmins districts. For the second consecutive year, the heaviest damage was found in Hutcheon Township, Chapleau District, where 8% of the trees were affected (Table 14). Trees are considered to be severely affected when the infection develops on the main stem, where it can girdle and kill young trees.

This stem and branch disease requires an alternate host to complete its cycle. Jack pine is the primary host, whereas sweetfern (*Comptonia peregrina*) and sweetgale (*Myrica gale*) are the alternate hosts. The presence of an alternate host is necessary to permit a final species identification.

Table 14. Damage caused by sweetfern blister rust in jack pine plantations in the Northern Region of Ontario in 1990 (counts based on an examination of 150 randomly selected trees at each location).

Location (Twp)	Avg. ht. of trees (m)	Estimated no. of trees per ha	Estimated area affected (ha)	Trees affected (%)	Trees severely affected (%)
Chapleau District					
Cortez	1.0	4,000	12	2.7	2.0
DeGaulle	2.0	2,500	10	5.0	5.0
Horwood	0.7	4,444	10	2.7	2.0
Hutcheon	1.5	1,500	20	8.0	8.0
Reaney	0.5	2,500	35	2.0	2.0
Gogama District					
Invergarry	1.0	2,500	50	6.7	5.0
Invergarry	0.5	2,500	7	2.0	2.0
Vrooman	1.0	2,500	20	2.0	2.0
Hearst District					
Arnott	2.7	2,000	200	0.7	0.7
Elgie	0.7	1,800	150	0.7	0.7
Kirkland Lake District					
Burt	2.2	4,200	3	1.3	1.3
Ossian	0.6	2,500	5	0.7	0.7
Timmins District					
Price	0.9	4,000	20	2.0	2.0

White Pine Blister Rust, *Cronartium ribicola* J.C. Fischer

This potentially serious disease of eastern white pine (*Pinus strobus* L.), although commonly found throughout the southern portion of the Region, has never reached serious damage levels (Table 15). This lack of development is largely due to the unavailability of large areas of natural or plantation white pine. Damage is generally confined to regeneration surrounding large trees or in mixed coniferous plantations (as is the case in Duff Twp, Cochrane District).

Tar Spot Needle Cast, *Davisomycella ampla* (J. Davis) Darker

This needle cast of jack pine was observed at low levels throughout the Region. However, light-to-moderate damage was found at several locations in the Chapleau and Gogama districts (Table 16). The greatest damage was found in a 20-ha plantation in Vrooman Township, Gogama District, where 70%

Table 15. Damage caused by white pine blister rust to young white pine in the Chapleau and Cochrane districts of Ontario in 1990.

Location (Twp)	Avg. ht. of trees (m)	No. of trees examined	No. of trees affected	Trees affected (%)
Chapleau District				
Abney	1.3	25	6	24
Cortez	1.2	37	11	30
Genier	1.0	80	11	14
Gilliland	1.1	50	4	8
Green	0.8	30	9	30
Kelso	0.7	20	3	15
Kosny	1.0	26	5	19
Neill	1.3	27	7	26
Topham	1.0	29	5	17
Cochrane District				
Duff	3.0	150	2	2

Table 16. Damage caused by tar spot needle cast in jack pine plantations in the Northern Region of Ontario in 1990 (counts based on an examination of 150 randomly selected trees at each location).

Location (Twp)	Avg. ht. of trees (m)	Estimated no. of trees per ha	Estimated area affected (ha)	Trees affected (%)	Foliar damage (%)
Chapleau District					
Carty	2.0	2,500	120	10	20
Copperfield	1.5	2,500	30	25	30
DeGaulle	1.5	2,500	10	65	20
Hutcheon	1.0	1,600	25	18	25
Nimitz	1.0	2,500	15	99	7
Reaney	0.5	4,400	65	16	30
Cochrane District					
Arnott	2.7	2,000	200	9	2
Stimson	2.5	2,300	12	8	9
Gogama District					
Garibaldi	1.0	2,500	250	33	40
Invergarry	1.0	2,500	50	21	40
Vrooman	1.0	4,400	30	70	35
Kirkland Lake District					
Chamberlain	3 3	2,500	10	11	4
Timmins District					
Macklem	2.8	2,000	4	11	3

of the 1-m trees were infected, with 35% foliar damage. Although light defoliation has little impact on the host, heavy defoliation can weaken trees and cause a reduction in growth.

This early-season foliar disease of jack pine causes discoloration and premature drop of the previous year's foliage. In mid-spring, the fruiting bodies of this pathogen are produced on the 1-year-old needles. When the fruiting bodies mature, they discharge their spores in wet weather and infect the current year's foliage. After infecting the current year's growth, the previous year's foliage is shed. During the year, the fungus develops in the newly infected foliage and the cycle continues the following spring.

Western Gall Rust, *Endocronartium harknessi* (J.P. Moore) Y. Hirats.

As in the previous 3 years, this rust was found at various levels in many jack pine stands and plantations throughout the Region. In most cases, branch galls are more common, but stem galls can girdle and kill smaller trees, and are regarded as more severe infections. The heaviest damage occurred in a 10-ha plantation in Neelands Township, Chapleau District, where 56% of the trees were affected, 44% with stem cankers (Table 17).

Table 17. Damage caused by western gall rust in jack pine plantations in the Northern Region of Ontario in 1990 (counts based on an examination of 150 randomly selected trees at each location).

Location (Twp)	Avg. ht. of trees (m)	Estimated no. of trees per ha	Estimated area affected (ha)	Trees affected (%)	Trees severely affected (%)
Chapleau District					
Alcona	0.5	4,444	12	2	2
Carty	2.0	2,500	120	3	3
Caverly	0.5	1,600	8	30	30
Dalmas (Island Lake TIA)[a]	1.3	2,500	12	7	[illegible]
DeGaulle	1.5	2,500	10	46	2[illegible]
Hutcheon	1.5	1,600	25	7	2
Ivy (north)	1.0	4,444	100	3	2
Ivy (south)	1.0	2,500	25	3	3
Neelands	1.0	2,500	10	56	44
Nimitz	1.8	2,500	80	10	8
Reaney	0.5	4,444	65	8	3
Silk	2.5	2,500	50	10	4
Cochrane District					
Stimson	2.5	2,300	12	3	0

(cont'd)

Table 17. Damage caused by western gall rust in jack pine plantations in the Northern Region of Ontario in 1990 (counts based on an examination of 150 randomly selected trees at each location) (concl.).

Location (Twp)	Avg. ht. of trees (m)	Estimated no. of trees per ha	Estimated area affected (ha)	Trees affected (%)	Trees severely affected (%)
Gogama District					
Garibaldi	1.0	2,500	250	2	2
Invergarry	0.5	2,500	7	6	6
MacMurchy	1.4	2,500	27	25	25
Vrooman	1.0	2,500	30	4	4
Hearst District					
Chelsea	1.8	1,800	25	1	0
Elgie	0.7	1,800	150	5	0
Kirkland Lake District					
Burt	2.2	4,200	3	1	1
Flavelle	1.8	2,500	10	1	0
McGarry	2.0	4,200	10	9	9
Timmins District					
Macklem	2.8	2,000	4	3	1

[a] Tree Improvement Area

Table 18. Other forest diseases.

Organism	Host(s)	Remarks
Chrysomyxa pirolata (Körn.) Winter Spruce cone rust	wS	Damage to approximately 2% of the cones was recorded throughout a 280-ha plantation of 2.2-m trees in Chelsea Township, Hearst District.
Ciborina whetzelii (Seaver) Seaver Ink spot of aspen	tA	Sporadic damage averaging 5% was recorded on small groups (≥0.5ha) of semimature trees across the Region. Younger trees frequently sustained heavier damage, as in Bracken Twp, Chapleau District, where a 0.5-ha area of approximately 3-m trees experienced 10% defoliation.

(cont'd)

Table 18. Other forest diseases (cont'd).

Organism	Host(s)	Remarks
Davisomycella fragilis Darker Needle cast	jP	Defoliation of 50% was recorded on the old foliage of 8-m trees throughout a 3-ha area of natural forest in Farquhar Township, Hearst District.
Inonotus tomentosus (Fr.) Teng Tomentosus root rot	bS	2.2% of the mature trees blew over as a result of damage by root rot in the acid rain plot in Hopkins Twp, Kapuskasing District.
Isthmiella faullii (Darker) Darker Needle cast	bF	50% of 1-m regeneration was affected in a 2-ha stand, with an average foliar damage level of 20%, in Reaney Twp, Chapleau District.
Linospora tetraspora G.E. Thompson Linospora leaf blight	bPo	Dramatic increases in infection levels were experienced across the Kapuskasing, Hearst and Cochrane districts. The heaviest (100%) early leaf drop was recorded throughout Cochrane District and, to a lesser degree, throughout the two other districts.
Lophodermium piceae (Fuckel) Höhnel Spruce needle cast	bS	1.1% of the trees in the acid rain plot had 5% of their lower branches infected in Hopkins Twp, Kapuskasing District.
Marssonina brunnea (Ell. & Ev.) Magnus Marssonina leaf spot	tA	Many trees in clumps of up to 0.5 ha had 100% defoliation in Clute Twp along Hwy 579 in Cochrane District.
Melampsora paradoxa Dietel & Holway Larch-willow rust	tL	100% of the trees had 2% affected foliage in a 2-ha experimental plot at Wally Creek, Dempsay Twp, Cochrane District.

(cont'd)

Table 18. Other forest diseases (concl.).

Organism	Host(s)	Remarks
Pucciniastrum epilobii Otth. Fir-fireweed rust	bF	100% of the 1-m regeneration was affected, with an average of 5% foliar damage, in a 15-ha area, in Panet Twp, Chapleau District.
Rhizosphaera kalkhoffii Bubák Needle blight	bS	At the Bonner Centre, Fauquier Twp, Kapuskasing District, an average of 40% of the lower branches of 3-m trees was affected over an area of 2 ha.
Septoria alni Sacc. Alder leaf spot	Al	Pockets of up to 100% affected foliage occurred on native trees in the Wally Creek Experimental Area, Dempsay Twp, Cochrane District.
Septoria betulae Pass. Leaf blight	wB	Early fall coloring of foliage in the northern portion of the Kirkland Lake and Timmins districts was attributed to severe (80-100%) damage by this organism, particularly in the area north of Hwy 101.
Uredinopsis sp. Needle rust	bF	100% of the trees were affected, with 5% foliar damage, in a 10-ha area, Birch Twp, Chapleau District.
Venturia macularis (Fr.) E. Müller & v. Arx Shoot blight	tA	Moderate levels of shoot damage occurred on young, regeneration trees across the Region.

ABIOTIC CONDITIONS

Blowdown

Strong winds experienced across the Region in the late fall of 1989 were responsible for several areas of forest damage. A number of small pockets of blowdown totaling approximately 400 ha were sketch-mapped this summer across the central portion of the Kapuskasing and Cochrane districts and in the western portion of Timmins District. Numerous small pockets of trees up to 1 ha in size were totally flattened; however, the majority of the damage occurred to scattered individual trees over areas of up to 20 ha.

The heaviest recorded damage occurred in Guilfoyle and Tucker townships, Kapuskasing District; in Agate and Swartman townships, Cochrane District; and in Frey, Sewell and Kenogaming townships, Timmins District. The principal species affected were black spruce trees on lowlying sites, and in some instances, adjacent balsam fir (*Abies balsamea* L. Mill.), white birch and trembling aspen.

Balsam Fir Mortality

Single-tree mortality of balsam fir was observed sporadically across the entire Region during aerial mapping. The 1 to 2% stand mortality was distributed fairly evenly, except in an area around Granitehill Lake, Drew township, in the southwestern corner of Hearst District, where damage to the stand was approximately 5%. The sporadic occurrence of dead trees was unaffected by either aspect or elevation. Upon closer examination, no mortality could be attributed directly to any insects or diseases.

Drier-than-normal growing periods in both 1988 and 1989 may have been a factor in this phenomenom, since balsam fir has a very shallow, compact root system and is more vulnerable to water deficits than are most coniferous species.

Frost Damage

Adverse (cool) weather conditions existed across the Region from 1 to 11 May. During this period, temperatures ranged between -7 and 12.7°C; the most damaging day was 10 May, when temperatures ranged between -0.6 and -4.9°C. This resulted in frost damage to new shoots on conifers and new leaves on trembling aspen throughout the central and northern portions of the Region.

Up to 100% of young white spruce sustained up to 5% foliar damage in Thorning, Calder and Glackmeyer townships, Cochrane District. Young black spruce exhibited trace levels of damage on 80% of the trees in Teetzel Township, Kapuskasing District. Damaged areas were characteristically more open, lowlying plantations or natural regeneration, and were normally from 0.5 to 5 ha in size.

Storm Damage

Up to 25 cm of wet snow fell in the first week of May and was responsible for considerable damage to the forests across the entire region. Approximately 5% of the 18-m-tall jack pine were broken off 10 to 15 m above the ground in a 50-ha natural stand in Alderson Township, Hearst District. Broken tops were observed on jack pine in small groups and as single trees north of the town of Chapleau. Throughout the damaged area, trees of all ages and species had broken branches and bent-over stems. In many cases, the trees are permanently bent and will not recover; some have already been uprooted.

FOREST HEALTH

Acid Rain National Early Warning System (ARNEWS)

In 1990, the fifth year since the establishment of the ARNEWS plots, an extensive reassessment was required for each plot. Various parameters including DBH, tree height, length of live crown and crown width were remeasured in each plot. Branches collected from off-plot trees were used for various measurements including percentage needle retention and shoot length. These branch samples were then submitted to the laboratory in Sault Ste. Marie for nutrient analysis. Increment cores were also collected from the off-plot trees. Finally, a soil pit was dug at each plot for soil analysis.

Each plot is checked annually for insect and disease damage. Trace levels of damage from the pitch nodule moth (*Petrova wenzeli* [Kft.]) were encountered at the plot in Deans Township, Chapleau District and the one in Cain Township, Kirkland Lake District. Low population levels of the Saratoga spittlebug (*Aphrophora saratogensis* [Fitch]) were found in the Kirkland Lake plot. The plot in Hopkins Township, Kapuskasing District, had 6% of the trees damaged by wind. In all three plots, light mortality of suppressed trees was recorded.

White Birch Health

Observations of birch (*Betula* spp.) dieback throughout northern Ontario in recent years prompted FIDS to conduct special surveys in 1989 and 1990. These surveys included both aerial and ground observations. In 1989, two semipermanent plots were established to monitor dieback: One plot is located in Borden Township, Chapleau District, and the other is on the Detour Lake Road, 120 km northeast of the town of Cochrane in Cochrane District. From initial surveys it appears that most damage found in these two plots is in dieback classes 1 and 2 (Table 19), which indicates less than 20% dieback.

Table 19. Birch health at two locations in the Northern Region of Ontario in 1990 (100 trees were examined at each location).

Location	Avg. ht. (m)	Avg. DBH (cm)	Current dieback[a] 0	1	2	3	4	5	Cumulative dieback[b] 0	1	2	3	4	5
			No. of trees											
Chapleau District														
Borden Twp	14.5	25.0	22	63	14	0	0	1	22	33	26	11	7	1
Cochrane District														
Detour Lk. Rd. km. 120	14.3	23.2	83	11	4	0	1	1	11	58	25	4	1	1

[a] Class 0 = 0-5%, 1 = 6-20%, 2 = 21-40%, 3 = 41-60%, 4 = >60%, 5 = dead

SPECIAL SURVEYS

Black Army Cutworm, *Actebia fennica* (Tausch.)

In 1990, an intensive survey was carried out in burned-over areas to determine the presence and impact of this insect. The adults of this pest are attracted to recently burned areas to lay their eggs. The following spring, the larvae begin to feed. Their preferred food is herbaceous plants such as fireweed (*Epilobium* spp.). However, if there are not enough plants available, they will turn to young coniferous seedlings, and damage to forest tree species becomes apparent.

Early in 1990, areas burned in 1989 were extensively searched for the presence of larvae and any feeding damage to the herbaceous plants. Observations at five separate locations in the Region yielded only a single larva, in Legge Township, Hearst District. No defoliation by the cutworm was found on the plant life at any location. Later in the season, a pheromone trapping program was carried out in six areas that were burned in 1990. Five of these locations were former prescribed burns and one was in a former wildfire area in Collins Township, Chapleau District. Results of the trapping program are presented in Table 20. It is anticipated that areas trapped in 1990 will be reexamined for the presence of larvae and damage in 1991.

Table 20. Results of the black army cutworm pheromone trapping program.

Location (Twp)	Total number of male moths caught
Chapleau District	
Collins	0
Delmage	244
Marshall	0
Hearst District	
Elgie	226
Legge	198
Minnipuka	370

Forest Tree Nursery Report

During 1990, a minimum of six visits was paid to each of the forest tree nurseries at Chapleau, Gogama and Kirkland Lake (Swastika). Summaries of the insect and disease conditions encountered during these visits were discussed with appropriate contact people at the nurseries after each visit.

During the past year, Chapleau Nursery was examined weekly. The only pathogen found was *Cylindrocladium* sp. However, it was found only at low levels, on less than 2% of the seedlings.

At the Gogama Nursery, an area of mortality was found in one 6-ha field. Along the eastern edge of this field, 65% of the black spruce seedlings were dead, representing 20% of the entire field. After consultation with nursery personnel, we concluded that this condition was caused by a combination of the pathogen *Fusarium* sp. and poor overwinter storage. A white spruce plantation being grown as a future seed orchard was the site of a moderate infestation by the yellowheaded spruce sawfly (*Pikonema alaskensis* [Roh.]). Here, in a 2-ha area, 25% of the 1.5-m trees were affected, with an average defoliation level of 10%.

Problems encountered on growing stock at the Swastika Nursery in 1990 included 1 to 5% mortality from heavy snow loads in compartments K7, K8 and D11. Damage to roots by a root rot (*Cylindrocladium floridanum* Sob. & C.P. Seym.) was recorded in approximately 20% of the extreme northeastern portion of compartment H11, and in approximately 10% of the compartment as a whole. Hedgerows of white spruce between the compartments exhibited trace damage by spruce needle rust (*Chrysomyxa ledi*), needle cast (*Isthmiella crepidiformis* [Darker] Darker) and, in one instance, by fir coneworm (*Dioryctria abietivorella* [Grt.]) larvae. Heavy cone crops on the hedgerow trees adjacent to compartment H19 also showed signs of approximately 5% damage due to a combination of feeding by the spruce cone maggot (*Lasiomma anthracinum* [Czerny]), the fir coneworm, and the spruce seed moth (*Cydia strobilella* [L.] = *youngana* [Kft.]).

Clonal archives and young jack pine trees adjacent to the seedling beds also sustained low levels (1-3%) of damage by the northern pitch twig moth (*Petrova albicapitana* [Bsk.]), eastern pine shoot borer (*Eucosma gloriola* Heinr.), pine spittlebug (*Aphrophora cribrata* [Wlk.]), and white pine weevil (*Pissodes strobi* [Peck]).

Gypsy Moth Pheromone Trapping

Pheromone traps were deployed again in 1990 in the 12 provincial parks and one private park located across the Region. As in previous years, two traps were deployed in all parks except those in which positive catches were recorded in the previous year. When new catches are recorded at any location, an additional eight traps (for a total of 10) are deployed in the following year to more closely monitor a potential build-up of adult male moths in the area.

In general, trace populations (from 1 to 3 adult males) have been captured infrequently in this trapping exercise; however, trapping in both Kap-Kig-Iwan and Esker Lakes provincial parks in Kirkland Lake District has resulted in catches over the past 3 years, and may represent areas of future concern (Table 21).

Table 21. Areas in which male gypsy moths have been caught in the Northern Region of Ontario.

Location	No. of moths trapped				
	1986	1987	1988	1989	1990
Chapleau District					
Missinaibi Lake Prov. Park	-	-	-	1	-
Mississagi Wild River Prov. Park	1	-	-	1	1
Wakami Lake Prov. Park	1	-	-	-	-
Hearst District					
Fushimi Lake Prov. Park	-	1	-	-	-
Kapuskasing District					
Remi Lake Prov. Park	-	-	-	-	1
Kirkland Lake District					
Esker Lakes Prov. Park	-	-	1	1	13
Kap-Kig-Iwan Prov. Park	1	-	1	3	14
Timmins District					
Kettle Lakes Prov. Park	-	1	-	-	2

Seed Orchard Survey

At the request of OMNR, a special survey of selected seed orchards was conducted in northern Ontario in 1990. Two areas were examined in Northern Region, one at the Island Lake Tree Improvement Area, Chapleau District, and the other at the Aidie Creek Seed Orchard, Kirkland Lake District. Each of these seed orchards contained two species, black spruce and jack pine. Two visits were made to each seed orchard, one before 15 June, and the other between 15 July and 15 August. During each visit, specific pests were sought.

Black spruce areas were examined for the following insects and diseases: the spruce budworm (*Choristoneura fumiferana*), the spruce coneworm (*Dioryctria reniculelloides*), the yellowheaded spruce sawfly (*Pikonema alaskensis*), the white pine weevil (*Pissodes strobi*), sawyer beetles (*Monochamus* spp.), frost damage, Armillaria root rot (*Armillaria ostoyae*), needle rust (*Chrysomyxa ledi* and *C. ledicola*), Diplodia tip blight (*Sphaeropsis sapinea*), and cone rust (*Chrysomyxa pirolata*). Any other insects or diseases were recorded (Table 22).

Jack pine areas were examined for the following insects and diseases: the jack pine budworm (*Choristoneura pinus pinus*), jack pine sawflies (*Neodiprion nanulus nanulus, N. pratti banksianae* and *N. virginiana*), the white pine weevil, the eastern pine shoot borer (*Eucosma gloriola*), the jack

Table 22. Insect and diseases damage in two black spruce seed orchards in the Northern Region of Ontario in 1990 (results based on an examination of 150 randomly selected trees at each location).

	Chapleau	Kirkland Lake
	Island Lake TIA	Aidie Creek
Avg. ht. (m)	0.5	0.9
Area (ha)	12	13
Trees/ha	2,500	2,500
Spruce budworm:		
trees affected (%)	0	0
Spruce coneworm:		
trees affected (%)	0	0
Defoliation by budworm/coneworm (%)	0	0
Yellowheaded spruce sawfly:		
trees affected (%)	0	15.3
defoliation (%)	0	3.0
Monochamus sp.:		
trees affected (%)	0	0
defoliation (%)	0	0
White pine weevil:		
leaders affected (%)	10.7	0.7
Pine spittlebug:		
trees affected (%)	0	9.3
Frost injury:		
trees affected (%)	0	0
foliar damage (%)	0	0
Armillaria root rot:		
trees affected	0	0
Needle rust:		
trees affected (%)	0	3.3
foliar damage (%)	0	2.0
Diplodia tip blight:		
trees affected (%)	0	0
Cone rust:		
trees affected (%)	0	0
cones affected (%)		
Misc. diseases	0	0

pine tip beetle (*Conophthorus resinosae*), the Swaine jack pine sawfly (*Neodiprion swainei*), pine needle rust (*Coleosporium asterum*), needle cast (*Davisomycella ampla*), Armillaria root rot, Scleroderris canker (*Ascocalyx abietina*), western gall rust (*Endocronartium harknessi*), and stem rust (*Cronartium* sp.). Other insects or diseases encountered were recorded (Table 23).

Table 23. Insect damage in two jack pine seed orchards in the Northern Region of Ontario in 1990 (results based on an examination of 150 randomly selected trees at each location).

	Chapleau	Kirkland Lake
	Island Lake TIA	Aidie Creek
Avg. ht. (m)	2.0	3.3
Area (ha)	12	10
Trees/ha	2,500	2,500
Jack pine budworm:		
trees affected (%)	0	0
defoliation (%)	0	0
Jack pine sawflies:		
trees affected (%)	0	0
no. of colonies	0	0
defoliation (%)	0	0
White pine weevil:		
leaders affected (%)	10.0	2.7
Pine shoot borer:		
laterals affected (%)	3.9	16.7
leaders affected (%)	1.3	1.3
Jack pine tip beetle:		
leaders affected (%)	0	0
Swaine sawfly:		
trees affected(%)	0	0
no. of colonies	0	0
defoliation (%)	0	0
Pine spittlebug:		
trees affected (%)	0	14.7
spittle masses per tree	0	2.2

(cont'd)

Table 23. Insect damage in two jack pine seed orchards in the Northern Region of Ontario in 1990 (results based on an examination of 150 randomly selected trees at each location) (concl.).

	Chapleau	Kirkland Lake
	Island Lake TIA	Aidie Creek
Needle rust:		
trees affected (%)	7.3	28.0
foliar damage (%)	2.0	3.5
Needle cast:		
trees affected (%)	0	11.3
foliar damage (%)	0	3.3
Armillaria root rot		
trees affected (%)	0	0.7
Scleroderris canker:		
trees affected (%)	0	0
severely affected (%)	0	0
Western gall rust:		
trees affected (%)	5.7	0
severely affected (%)	0	0
Stem rust:		
trees affected (%)	0	0
Misc. diseases	0	0

At Island Lake, the major problem for both jack pine and black spruce was the white pine weevil. Both species had at least 10% of the leaders attacked. This insect has been a problem at this seed orchard since 1987.

At Aidie Creek, the major problem for jack pine was the eastern pine shoot borer. Here, 18% of the trees were attacked, of which 1.3% had leader damage. The major problem for black spruce was the yellowheaded spruce sawfly. This insect attacked 15.3% of the trees, and caused an average of 3% defoliation.

Climatic Data

Temperature and precipitation have a great deal of influence on the presence and development of insects and diseases, and can greatly facilitate or hinder the development of damage from year to year. Similarly, adverse weather conditions can cause abiotic damage (e.g., hail, blowdown, drought) to the host trees, which could predispose them to insect or disease attack.

For these reasons, we have included current weather (temperature and precipitation) data along with a column for the deviation from normal figures for a representative selection of weather stations across the Region (Table 24).

Table 24. Mean temperature and total precipitation at three locations in the Northern Region of Ontario in 1990.

Location	Month	Mean temperature (°C) Normal	Mean temperature (°C) Actual	Deviation from normal (°C)	Total precipitation (mm) Normal	Total precipitation (mm) Actual	Deviation from normal (mm)
Chapleau Airport							
	Jan.	-16.9	-9.9	+7.0	46.9	85.2	+38.3
	Feb.	-15.8	-	-	34.5	-	-
	March	-8.3	-5.6	+2.7	56.2	49.6	-5.6
	April	0.6	-3.5	-4.1	59.3	40.4	-18.9
	May	8.6	-	-	73.8	-	-
	June	14.3	14.4	+0.1	100.4	133.2	+32.8
	July	16.8	16.6	-0.2	81.8	114.2	+32.2
	Aug.	15.4	15.6	+0.2	86.2	64.2	-22.0
	Sept.	10.4	10.1	-0.3	101.5	78.6	-22.9
	Oct.	4.9	2.9	-2.0	75.7	-	-
	Nov.	-3.5	-7.8	-4.3	64.2	102.6	+38.4
	Dec.	-12.8	-21.3	-8.5	53.5	65.8	+12.3
Earlton Airport							
	Jan.	-16.3	-10.8	+5.5	56.4	50.5	-5.9
	Feb.	-14.1	-13.9	+0.2	47.2	45.5	-1.7
	March	-7.6	-6.0	+1.6	58.0	38.8	-19.2
	April	1.9	4.1	+2.2	50.0	29.7	-21.3
	May	9.8	9.3	-0.5	61.3	72.4	+11.1
	June	15.2	15.4	+0.2	89.2	118.1	+28.9
	July	17.7	17.9	+0.2	80.8	58.4	-22.4
	Aug.	16.2	16.9	+0.7	83.4	79.2	4.2
	Sept.	11.1	10.2	-0.9	99.1	82.6	-16.5
	Oct.	5.4	4.1	-1.3	70.0	122.2	+52.2
	Nov.	-2.5	-1.3	+1.2	70.6	72.2	+1.6
	Dec.	-12.6	-10.5	2.1	65.3	42.4	-22.9
Kapuskasing Airport							
	Jan.	-18.6	-13.8	+4.8	53.6	66.2	+12.6
	Feb.	-16.2	-14.7	+1.5	43.0	43.7	+0.7
	March	-9.4	-5.0	+4.4	55.4	41.2	-14.2
	April	0.5	1.0	+0.5	53.2	66.4	+13.2
	May	8.3	7.2	-1.1	74.3	106.0	+32.7
	June	14.1	13.9	-0.2	84.7	162.8	+78.1
	July	16.8	17.4	+0.6	96.3	80.3	-16.0
	Aug.	15.3	15.6	+0.3	92.5	72.4	-20.1
	Sept.	10.0	8.9	-1.1	94.4	91.4	-3.0
	Oct.	4.4	2.9	-1.5	77.4	113.1	+35.7
	Nov.	-2.4	-2.8	-0.4	80.1	49.5	-30.6
	Dec.	-16.4	-14.5	+1.9	53.3	39.7	-13.6